WE CLAIM:

1. A catalytic heat exchanger system for removing at least one pollutant from an air stream, comprising:

a first housing;

a catalytic precooler disposed within said first housing; and

an augmentative catalytic device disposed in series with said catalytic precooler, wherein each of said catalytic precooler and said augmentative catalytic device is adapted for passage of said air stream therethrough, and wherein each of said catalytic precooler and said augmentative catalytic device is adapted for removal of said at least one pollutant from said air stream.

2. The catalytic heat exchanger system of claim 1, wherein each of said catalytic precooler and said augmentative catalytic device is adapted for passage of said air stream therethrough at a flow rate of from about 20 to 400 pounds of air per minute.

3. The catalytic heat exchanger system of claim 1, wherein said augmentative catalytic device has a weight in the range of from about 2.0 to 4.0 Kg.

4. The catalytic heat exchanger system of claim 1, wherein said augmentative catalytic device is located upstream from said catalytic precooler.

5. The catalytic heat exchanger system of claim 1, wherein said augmentative catalytic device is located downstream from said catalytic precooler.

6. The catalytic heat exchanger system of claim 1, wherein said

augmentative catalytic device is disposed within said first housing.

7. The catalytic heat exchanger system of claim 1, further comprising a second housing, wherein said augmentative catalytic device is disposed within said second housing.

8. The catalytic heat exchanger system of claim 7, wherein said second housing is disposed upstream from said first housing.

9. The catalytic heat exchanger system of claim 7, wherein said second housing is disposed downstream from said first housing.

10. The catalytic heat exchanger system of claim 1, wherein said catalytic precooler has a crossflow plate-fin configuration defining a plurality of hot pass passages and a plurality of cold pass passages, and wherein said catalytic precooler includes a catalyst support disposed within said plurality of hot pass passages.

11. The catalytic heat exchanger system of claim 1, wherein said catalytic precooler comprises a plurality of hot pass passages arranged longitudinally within said first housing, and a catalyst support disposed within said plurality of hot pass passages.

12. The catalytic heat exchanger system of claim 11, wherein each of said plurality of hot pass passages is cylindrical.

13. The catalytic heat exchanger system of claim 1, wherein said augmentative catalytic device comprises a plate-fin substrate.

14. The catalytic heat exchanger system of claim 13, wherein said

plate-fin substrate comprises a plurality of channels selected from the group consisting of a plurality of straight channels and a plurality of off-set channels.

15. The catalytic heat exchanger system of claim 14, wherein said plurality of channels are arranged in a spiral configuration or a concentric ring configuration.

16. The catalytic heat exchanger system of claim 15, wherein said plate-fin substrate comprises said plurality of straight channels arranged in said spiral configuration.

17. The catalytic heat exchanger system of claim 15, wherein said plate-fin substrate comprises said plurality of off-set channels arranged in said concentric ring configuration.

18. The catalytic heat exchanger system of claim 1, wherein each of said catalytic precooler and said augmentative catalytic device is adapted for catalytic ozone conversion.

19. The catalytic heat exchanger system of claim 1, wherein each of said catalytic precooler and said augmentative catalytic device has a catalytic ozone conversion efficiency of at least about 60 % after operation for 30,000 hours.

20. The catalytic heat exchanger system of claim 1, wherein said catalytic precooler and said augmentative catalytic device have a combined catalytic ozone conversion efficiency of at least about 85 % after operation for 30,000 hours.

21. A catalytic heat exchanger system, comprising:

a first housing;

a catalytic precooler disposed within said first housing;

a second housing; and

an augmentative catalytic device disposed within said second housing, wherein said augmentative catalytic device is disposed in series with said catalytic precooler, wherein each of said catalytic precooler and said augmentative catalytic device is adapted for passage of an airstream therethrough, and wherein each of said catalytic precooler and said augmentative catalytic device is independently capable of catalytic ozone conversion.

22. The catalytic heat exchanger system of claim 21, wherein said catalytic precooler comprises a plurality of hot pass passages arranged longitudinally within said first housing, a first catalyst support disposed within said plurality of hot pass passages, and at least one catalyst disposed on or within said first catalyst support.

23. The catalytic heat exchanger system of claim 21, wherein said augmentative catalytic device comprises a plurality of channels arranged longitudinally within said second housing, a second catalyst support disposed within said plurality of channels, and said at least one catalyst disposed on or within said second catalyst support.

24. The catalytic heat exchanger system of claim 23, wherein said augmentative catalytic device has a circular configuration

25. The catalytic heat exchanger system of claim 24, wherein said plurality of channels are arranged in a spiral configuration, and wherein each of said plurality of channels comprises a straight channel.

26. The catalytic heat exchanger system of claim 24, wherein said plurality of channels are arranged in a concentric ring configuration, and wherein each of said plurality of channels comprises an off-set channel.

27. The catalytic heat exchanger system of claim 21, wherein said plurality of channels have a cell density of from about 400 to 600 cells per square inch of axial surface of said augmentative catalytic device.

28. A catalytic heat exchanger system for the removal of at least one pollutant from an air stream, comprising:

a first housing;

a catalytic precooler disposed within said first housing, wherein said catalytic precooler comprises a plurality of hot pass passages arranged longitudinally within said first housing, a first catalyst support disposed within said plurality of hot pass passages, and at least one catalyst disposed on or within said first catalyst support; and

an augmentative catalytic device disposed in series with said catalytic precooler, wherein said augmentative catalytic device comprises a plurality of channels, and a second catalyst support disposed within said plurality of channels, and said at least one catalyst disposed on or within said second catalyst support, said at least one catalyst adapted for catalytic ozone conversion, said augmentative catalytic device having a circular configuration selected from the group consisting of a spiral configuration and a concentric ring configuration, wherein said plurality of channels are selected from the group consisting of straight channels and off-set channels, and wherein said catalytic precooler and said augmentative catalytic device have a combined ozone conversion efficiency of at least about 85% after operation of said catalytic heat exchanger system for a period of about 30,000 hours.

29. The catalytic heat exchanger system of claim 28, wherein said augmentative catalytic device is disposed within said first housing.

30. The catalytic heat exchanger system of claim 28, further comprising a second housing, said augmentative catalytic device disposed within said second housing, and wherein said plurality of channels are arranged longitudinally within said second housing.

31. The catalytic heat exchanger system of claim 28, wherein said augmentative catalytic device is located upstream from said catalytic precooler.

32. An environmental control system for providing conditioned air to a cabin of a vehicle, comprising:

a catalytic heat exchanger system adapted for removing at least one pollutant from an air stream, and said catalytic heat exchanger system further adapted for cooling said air stream; and

at least one duct coupled to said catalytic heat exchanger system for providing said air stream to said catalytic heat exchanger system from a compressed air source, wherein said catalytic heat exchanger system comprises:

a catalytic precooler disposed within a first housing; and

an augmentative catalytic device disposed in series with said catalytic precooler.

33. The environmental control system of claim 32, wherein said catalytic precooler comprises a plurality of hot pass passages arranged longitudinally within said first housing, a first catalyst support disposed within said plurality of hot pass passages, and at least one catalyst disposed on or within said first catalyst support.

34. The environmental control system of claim 32, wherein said augmentative catalytic device is disposed upstream from said catalytic precooler.

35. The environmental control system of claim 32, wherein said augmentative catalytic device is disposed within said first housing.

36. The environmental control system of claim 32, wherein said augmentative catalytic device comprises a plurality of channels, and a second catalyst support disposed within said plurality of channels, and said at least one catalyst is disposed on or within said second catalyst support.

37. A vehicle, comprising:

at least one environmental control system for providing conditioned air to a cabin of said vehicle; and

at least one compressed air source for providing an air stream to said at least one environmental control system, wherein said environmental control system comprises a catalytic heat exchanger system adapted for cooling said air stream and for catalytically removing at least one pollutant from said air stream, wherein said catalytic heat exchanger system comprises:

a catalytic precooler disposed within a first housing; and

an augmentative catalytic device disposed in series with said catalytic precooler, wherein each of said catalytic precooler and said augmentative catalytic device is independently capable of catalytic ozone conversion.

38. The vehicle of claim 37, wherein each of said catalytic precooler and said augmentative catalytic device is independently capable of an initial catalytic ozone conversion efficiency of at least about 80%.

39. The vehicle of claim 37, wherein each of said catalytic precooler and said augmentative catalytic device is independently capable of a second catalytic ozone conversion efficiency of at least about 60% after about 30,000 hours of operation.

40. The vehicle of claim 37, wherein said catalytic precooler and said augmentative catalytic device have a combined second catalytic ozone conversion efficiency of at least about 85% after about 30,000 hours of operation.

41. The vehicle of claim 37, wherein said at least one compressed air source comprises a gas turbine engine.

42. The vehicle of claim 37, wherein said vehicle comprises a commercial wide-body aircraft.

43. A method for providing cleansed air to a cabin of a vehicle, comprising:

a) providing an airstream from a compressor;

b) passing said airstream through a first catalytic device; and

c) after said step b), passing said airstream through a second catalytic device, wherein said second catalytic device is arranged in series with said first catalytic device, and wherein each of said first catalytic device and said second catalytic device is independently capable of catalytic ozone conversion.

44. The method of claim 43, wherein said first catalytic device and said second catalytic device have a combined initial ozone conversion efficiency of at least about 95%.

45. The method of claim 43, wherein said first catalytic device and

said second catalytic device have a combined second ozone conversion efficiency of at least about 85% after said steps b) and c) have been performed for about 30,000 hours.

46. The method of claim 43, wherein said first catalytic device comprises a catalytic precooler and said second catalytic device comprises an augmentative catalytic device.

47. The method of claim 43, wherein said first catalytic device comprises an augmentative catalytic device and said second catalytic device comprises a catalytic precooler.